March 30, 1948. M. RESEK ET AL 2,438,823

ELECTRICAL IGNITER FOR POT-TYPE LIQUID FUEL BURNERS

Filed Dec. 16, 1943 3 Sheets-Sheet 1

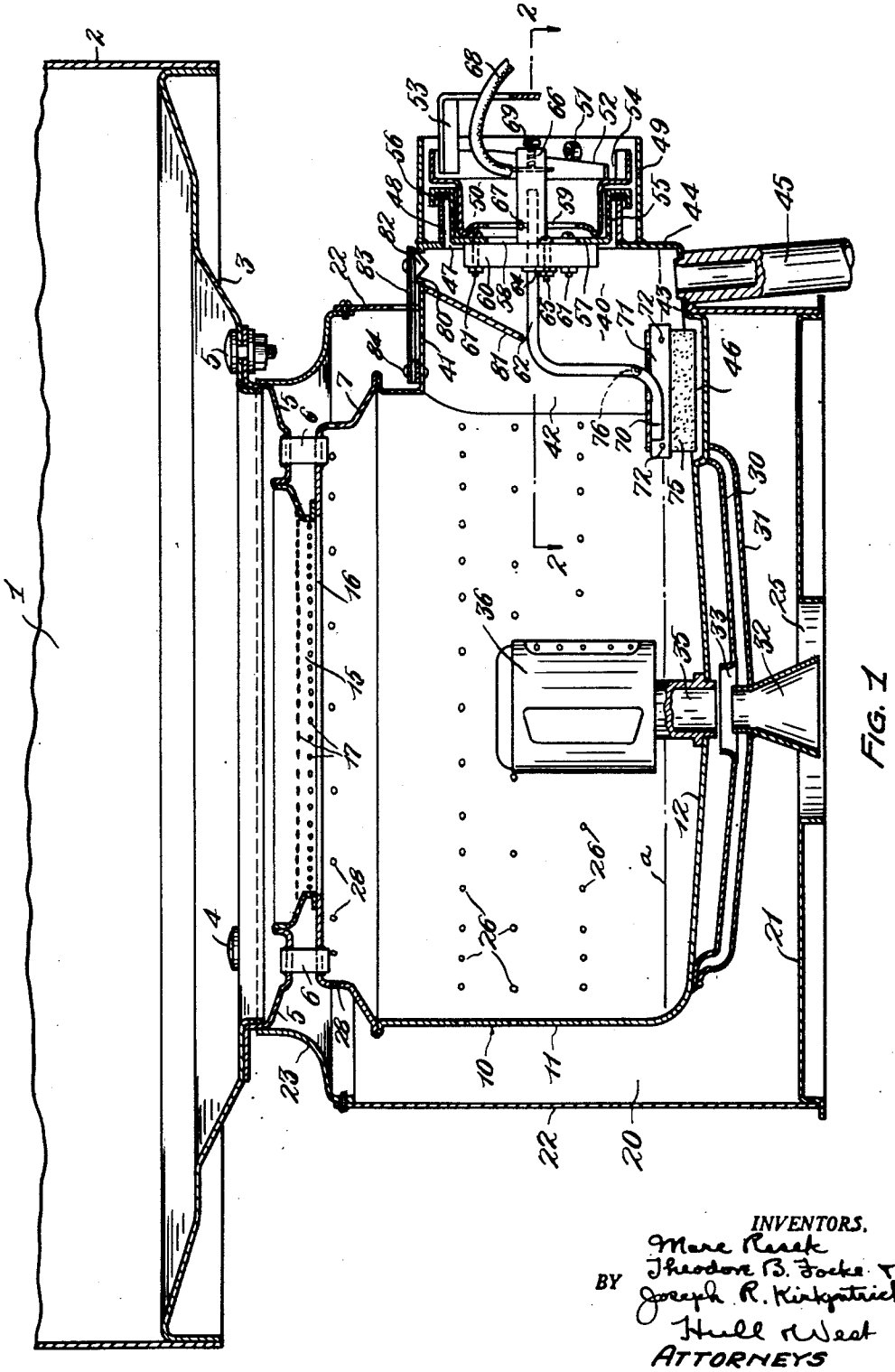


FIG. 1

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Filed Dec. 16, 1943 3 Sheets-Sheet 2

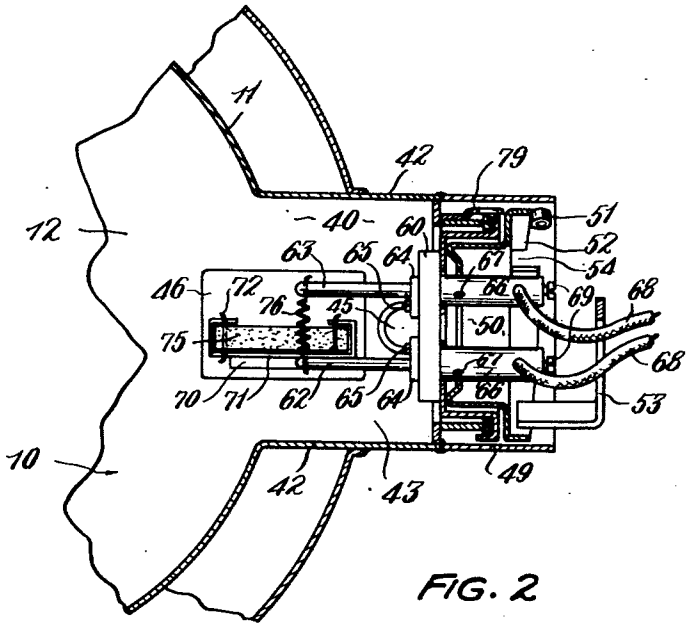


FIG. 2

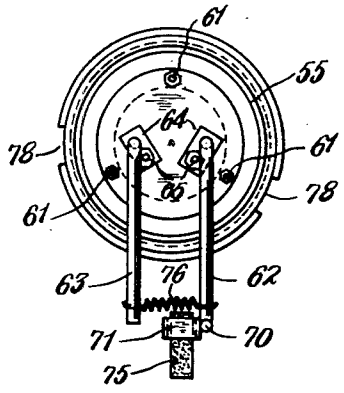


FIG. 3

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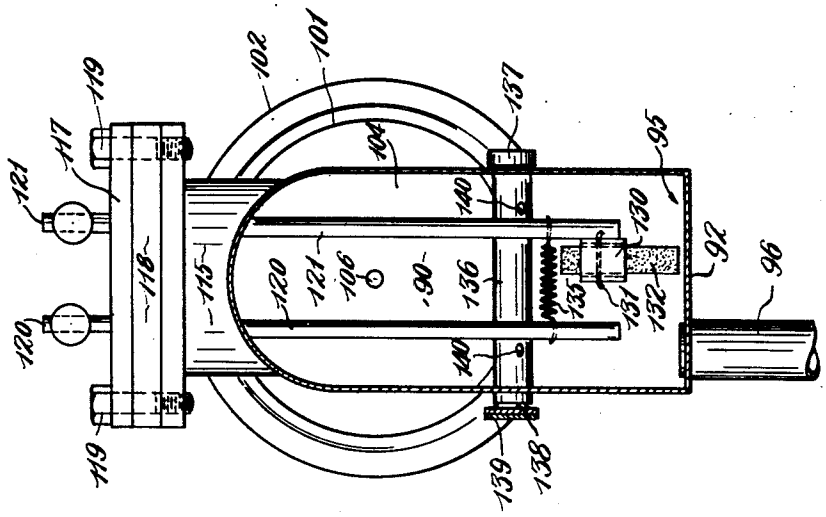


FIG. 5

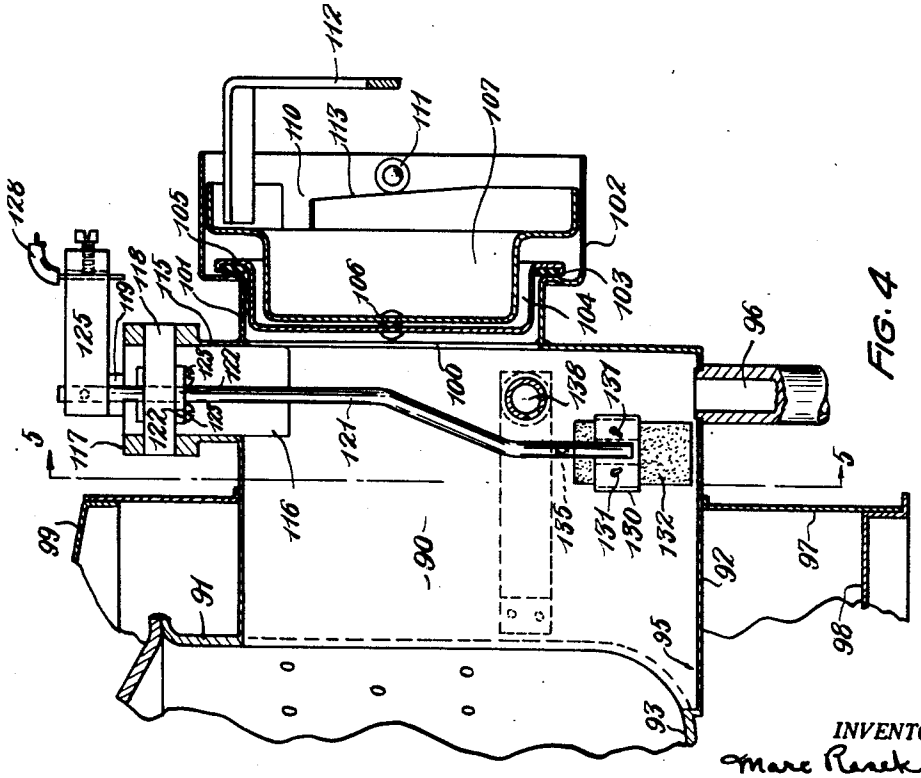


FIG. 4

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UNITED STATES PATENT OFFICE

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ELECTRICAL IGNITER FOR POT-TYPE LIQUID FUEL BURNERS

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Application December 16, 1943, Serial No. 514,468

4 Claims. (Cl. 158—28)

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This invention relates to electrical igniters for incorporation in liquid fuel burners, and more particularly to a hot wire electrical igniter for that class of liquid fuel burners wherein the liquid fuel is vaporized and burns from a pool of fuel contained in a sump that is in open communication with the interior of a burner bowl and which sump may consist of the bottom of the bowl, or an included portion of such bottom less than the whole, or an extension thereof.

The main object of the invention is to provide a hot wire electrical igniter that is reliable and effective in lighting the burner under widely different conditions, as, first, when the burner parts are cold and the surrounding atmospheric temperature is low; secondly, when the operation of the burner has been temporarily suspended—as when the fire has been accidentally extinguished—and the burner parts are hot, and thirdly, when the sump is flooded to its maximum level.

The difficulty of providing an igniter that will function properly under these widely different conditions will be better appreciated when it is remembered that in order to accomplish ignition there must be a vaporization of the fuel in the immediate vicinity of the hot wire and in the presence of sufficient oxygen to support combustion, and under low temperature conditions there is usually some difficulty in vaporizing the fuel, while under very high temperature conditions, as when the burner parts are extremely hot, there is an absence of oxygen which makes the vapors in the immediate vicinity of the hot wire too rich to burn. As stated above, it is an object of the invention to produce a hot wire electrical igniter that will operate satisfactorily under the three above mentioned extreme conditions.

Another object of the invention is the production of a hot wire electrical igniter for burners of the class above referred to that remains freer from carbon formation and deposit than prevailing electrical igniters.

Another object is the production of an electrical igniter in the form of a unit or assembly that is adapted for incorporation in existing burner constructions with very little change being necessary in the latter.

An important feature of the invention, and one that is responsible for the attainment of certain of the foregoing objects, resides in the fact that

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the hot wire or resistor coil is located above the maximum fuel level in the burner, so that at no time does it become wholly or partially inundated, and a suitable capillary element or wick is so arranged that a part dips into the fuel and conducts a small amount thereof into close enough proximity to the hot wire or resistor coil to effect vaporization of the fuel, and into such a relation to the wire or coil as to facilitate ignition of the vapors. However, the wire or coil is spaced from the capillary element or wick sufficiently to avoid actual contact of the fuel with the wire or coil which, if permitted to occur, would likely cool the wire or coil enough to hinder vaporization and ignition of the fuel.

In the practical application of our invention we prefer to combine with the igniter, means for supplying air to the immediate vicinity of the hot wire or resistor coil thereby to insure the formation of a combustible mixture in igniting relation to the wire or coil notwithstanding the possible presence of an exceedingly rich mixture resulting from a highly heated condition of the burner parts, as would happen when the fire is extinguished accidentally or otherwise, and the burner has to be immediately relighted.

Still further objects are to provide a relatively simple, inexpensive and substantial construction for electrical igniters for liquid fuel burners, and one that can be easily and quickly applied to and removed from the burner.

The foregoing objects, with others hereinafter appearing, are attained in the embodiments of the invention illustrated in the accompanying drawings wherein Fig. 1 is a vertical section through a liquid fuel burning apparatus incorporating one form of our improved igniter; Fig. 2 is a fragmentary horizontal section through said apparatus on the line 2—2 of Fig. 1; Fig. 3 is a view of the igniter assembly removed from the burner and viewed as though looking from the left of Fig. 1; Fig. 4 is a fragmentary vertical sectional view through liquid fuel burning apparatus that differs from the embodiment illustrated in Figs. 1 and 2 principally in the fact that the igniter is incorporated in the main burner structure, independently of the closure for the opening through which access is had to the interior of the burner bowl, and Fig. 5 is a sectional view on the line 5—5 of Fig. 4.

The heating apparatus illustrated in Figs. 1

and 2 comprises a combustion chamber 1 that is enclosed by a drum or casing 2, to the apertured bottom wall 3 of which is fastened, by means of bolts 4, a ring-like member 5. Secured, as by posts 6, to the member 5 in spaced relation thereto, is a top wall 7 of the burner bowl that is designated generally by the reference numeral 10. The upper end of the peripheral wall 11 of the burner bowl is welded or otherwise attached to the edge portion of the top wall 7, and shown as formed integral with the peripheral wall 11 is the slightly dished bottom wall 12.

A neck 15 connects the top wall 7 of the burner bowl, about a large central opening 16 thereof, with the inner edge of the beforementioned ring-like member 5, and said neck is provided with perforations 17 through which secondary air is admitted to the combustion space from a surrounding air compartment 20 enclosed by a bottom wall 21, a peripheral wall 22 and an upwardly convergent top wall 23 through which the peripheral wall 22 is joined to the ring-like member 5 in the region of the latter's connection with the bottom wall of the combustion chamber. Air is supplied to the compartment 20, either by natural or artificial draft, through an opening 25 in the bottom wall 21. The peripheral wall 11 of the burner bowl has air inlet openings 26, and the top wall 7 may also be provided with air openings, as shown at 28.

Insulating shells 30 and 31 are applied to the bottom wall 12 of the bowl, and the outer shell 31 is shown as having secured within a central aperture thereof the smaller upper end of a funnel 32 whose larger end is disposed within the air inlet opening 25. In register with the upper end of the funnel 32 is a central opening 33 of the inner shell 30, and arranged centrally within the burner bowl is an air tube 35 that has its lower end extended through an opening in the bottom wall 12 and to which wall the tube is suitably secured, as by welding. Mounted upon the air tube 35 is an air distributor 36 with the interior of which said tube communicates.

Extending from what may be regarded the front side of the burner bowl 10 is a bay 40 enclosed, excepting on the side that is in open communication with the interior of the bowl, by a top wall 41, side walls 42, a bottom wall 43, and a front wall 44. Fuel is supplied to the bowl from a suitable source (not shown) through a pipe 45 that opens through the bottom wall 43 adjacent the front wall 44. Formed in the adjoining portions of the bottom wall 43 of the bay and the bottom wall 12 of the bowl is a shallow basin 46. It will be observed that the bottom wall 43 has substantially the same inclination as the wall 12, wherefore, by reason of its location, the basin 46 will be supplied with and will constantly retain a certain quantity of fuel which is trapped therein as it flows from the pipe 45 to the main sump provided by the dished bottom wall of the bowl.

The front wall 44 of the bay 40 has a relatively large opening 47 through which access may be had to the interior of the bowl, and secured to said wall about said opening is a neck 48. Also carried by and projecting forwardly from the wall 44, in radially spaced relation to the neck 48, is a sleeve 49 within which is loosely fitted a plug 50 whose inner end portion is considerably less in diameter than the internal diameter of the neck 48 and whose outer end is enlarged to nearly the internal diameter of the sleeve 49. Projecting inwardly from the sleeve 49 adjacent the outer end thereof are stops, desirably arranged in diametrically opposed relation to each other and one of which is shown in the drawings and designated 51. The said stops are preferably in the form of rollers that are mounted upon studs carried by the sleeve 49, and the stops are arranged to contact cam edges 52 of the plug 50 when the latter is turned in an appropriate direction by a bail-like handle 53, the enlarged end of the plug having notches 54 for passage of the stops when the plug is inserted into or removed from the sleeve 49.

Interposed between the plug 50 and neck 48 is a closure 55 whose outer end is flanged radially outwardly and thence back over the body portion of the closure to form a channel within which is contained a gasket 56 for engagement with the front end of the neck 48 thereby to seal the opening 27 when the closure is urged inwardly by the plug 50. At its inner end the closure 55 is flanged inwardly, as shown at 57, about an opening 58 that aligns with an opening 59 in the adjacent end of the plug 50.

In the embodiment of the invention at present under consideration, the igniter—which I shall next describe—is carried by the closure 55. Extending across the opening 58 and overlying the flanged inner end 57 of the closure is a disk 60 of refractory insulating material, said disk being attached to the closure by bolts 61. Projecting outwardly through laterally spaced holes in the disk 60 are the shanks of electrodes 62 and 63. The electrodes consist of metallic rods, and suitably attached thereto are mounting plates 64 which, in turn, are attached to the disk 60 by bolts 65. Engaged over the shanks of the electrodes where they protrude beyond the front of the disk 60 are socketed terminal members 66, the same being held to said shanks by set screws 67. Conductors 68 supply current to the electrodes, their ends being engaged through transverse holes in the terminal members and being secured therein by screws 69, in accordance with common practice.

Inwardly of the disk 60 and above the basin 46 the electrodes are extended downwardly to provide vertical branches, that of the electrode 63 terminating a short distance above the basin 46, while the lower end of the electrode 62 is curved rearwardly to provide a substantially horizontal extension 70. Secured, as by welding, to the extension 70 is a yoke 71, formed from a strap of metal, and sustained within said yoke, by cross pins 72, is a capillary element or wick 75, desirably of suitable refractory material. Supported by and between the vertical branches of the electrodes 62 and 63, in slightly spaced relation to the top surface of the wick 75, is a coil 76 of suitable resistance wire, its ends being attached to the electrodes in such manner as to insure strong physical and efficient electrical connections between the parts.

To properly position the igniter with respect to the neck 48, so that the lower end of the wick 75 depends within the basin 46, lugs are associated with the neck and occupy notches in the periphery of the closure 55 when the igniter is in place. The notches are designated 78 in Fig. 3, while one of said lugs is shown at 79 in Fig. 2.

The presence of the igniter makes it desirable to augment the usual air supply of the burner by an auxiliary air supply that sweeps in about the igniter and, in the present construction, the auxiliary air supply enters through an opening 80 in the top wall 41 forwardly of the wall 22 of the air compartment 20. A baffle 81 directs the auxiliary air downwardly into the region

of the igniter. A valve 82 controls the admission of air through the opening 80 and is shown as carried directly by a bi-metal strip 83 that is fastened at 84 to the wall 41 inside the air compartment 20, the wall 22 being cut away to provide clearance for the bi-metal strip. It will be apparent to those acquainted with the art that, by this construction and arrangement, a thermostatic valve is provided that automatically controls the supply of auxiliary air. With the bi-metal strip installed with the layer having the higher coefficient of expansion on the underneath side, the valve will be closed when the burner parts are cold and opened when the burner parts are hot. By inverting the bi-metal strip, the action will be reversed. Assuming that the burner is not in operation and that its parts are at low temperature, the present illustration is of the first described installation, according to which the auxiliary air supply is shut off at the time the burner is started after being idle for some time, and is open during operation or whenever the burner parts are at high temperature. This is desirable in cold weather especially in very cold climates as it prevents the low temperature of the atmospheric air from interfering with the proper heating of the ignition coil and vaporization of the fuel in the immediate vicinity thereof. When the fuel is ignited and the burner is in operation and the parts thereof become heated, the bi-metal strip 83 will warp in a direction to open the valve 82 and admit air through the opening 80. This will tend to prevent formation and accumulation of carbon on the igniter parts—the presence of which greatly impairs the effectiveness of the igniter—and in case the fire is extinguished from any cause and it is desired to immediately relight the burner, the auxiliary air supply will provide the necessary oxygen to create a combustible mixture in the region of the igniter, insuring an immediate relighting of the burner upon energization of the igniting coil.

The type of burner at present under consideration is intended for use primarily in domestic furnaces, and in the more moderate climates where sub-zero temperatures are non-existent or uncommon, an advantage may be gained by arranging the thermostatic control of the auxiliary air supply to function in the reverse of that above described, in which case the valve 82 is open when the burner parts are cold and closes as the parts heat up. Under these circumstances there will be a downward and inward current of air about the igniter at the time the igniting coil is energized, and this will serve to direct the flame, created by an ignition of the vapors generated in the region of the coil, inwardly toward the main fuel supply of the burner and hasten ignition thereof. Thereafter, when the burner parts become hot, the valve 82 will automatically close and operation of the burner will proceed under its normal air supply and regulation.

When it is desired to remove the igniter for purposes of inspection, repair or replacement, or to clean out the burner bowl, the plug 50 may be rotated in a counterclockwise direction by means of the handle 53 to disengage it from the stops 51 and withdrawn, after which the closure 55 may be removed and with it the igniter assembly that is mounted thereon.

In starting the burner, the fuel supply is turned on, whereupon fuel enters through the pipe 45 and flows down over the inclined wall 43 into

the sump provided by the dished bottom wall 12 of the bowl, a quantity being trapped in the basin 46. Unless the burner is immediately lighted, the fuel accumulates to its maximum level, indicated by the dot-and-dash line *a* in Fig. 1. Fuel from the basin 46 will be conducted upwardly by the wick 75 until the wick is thoroughly saturated and a film of liquid fuel is disposed immediately below but in spaced relation to the underside of one end of the ignition coil 76, as will be seen by reference to Figs. 2 and 3. Now, by closing a switch, such as a push button (not shown), in an electric circuit including the conductors 68, current will be supplied to the ignition wire or coil 76. Upon the consequential heating of the wire or coil, the liquid fuel on the adjacent portion of the wick will be vaporized. The vapors in the immediate region of the coil and directly above the wick may be too rich to ignite, especially in the absence of an auxiliary air supply, while at the end of the coil remote from the wick the surrounding vapors might and probably would be too lean to ignite. Accordingly, somewhere between these two extremes there will be a zone of readily combustible mixture that will ignite from the hot wire or coil and as soon as a flame is thus created it will vaporize additional fuel and almost immediately combustion will be communicated to the main body of fuel in the burner bowl.

According to the embodiment at present under consideration, as the burner parts become heated the valve 82 will open and admit air to the burner bowl in the immediate vicinity of the igniter. As already explained, this will have the two-fold advantage of keeping the ignition coil clean and of supplying the oxygen constituent of a readily combustible mixture in the vicinity of the coil which, in case the fire is extinguished from any cause, will insure immediate relighting upon energization of the ignition coil.

In the embodiment of the invention illustrated in Figs. 4 and 5, a bay 90 extends from the front of the burner bowl 91 and its bottom 92 is sufficiently below the adjacent portion of the bottom wall 93 of the bowl to constitute of the entire bottom area of the bay a basin 95 in which a quantity of fuel will be trapped as the fuel flows from the supply pipe 96 to the main sump provided by the bottom portion of the burner bowl, as in the previously described construction. Also, in the present case, as in the first, an air compartment that surrounds the burner bowl is enclosed by a peripheral wall 97, a bottom wall 98 and a top wall 99. Attached to the front wall of the bay 90, in register with a relatively large opening 100 therein, is a cylindrical fitting 101, having an enlarged sleeve-like outer end 102, between which and the body portion of the fitting is a shoulder 103 against which the flanged outer end of a closure 104 is adapted to engage, the closure carrying a gasket 105 for contact with said shoulder. The closure 104 has a swivel connection, through a pivot member 106, with the inner end of a plug 107, the outer end of which is enlarged to nearly the internal diameter of the sleeve-like end 102 of the fitting 101. The outer end of the plug has diametrically opposed notches for the passage of stops that are carried by the surrounding portion of the fitting 101, the notch and stop at one side being shown in Fig. 4 where they are designated, respectively, 110 and 111. The plug is equipped with a handle 112 by which it is adapted to be turned to project cam-like edge portions, one of

which is shown at 113 in Fig. 4, beneath the stops 111. A neck 115 rises from the arched top wall of the bay 90 about an opening 116, and between the flanged upper end of said neck and a frame member 117 is clamped the marginal portion of a block 118 of refractory insulating material, the member 117 being drawn toward and attached to the flanged end of the neck 115 by screws 119.

Electrodes 120 and 121 have their upper ends projected through apertures in the block 118 and are attached to said block by mounting plates 122 and screws 123. Terminal members 125 are fastened to the upper ends of the electrodes and connected thereto are electrical conductors, one of which is shown at 128 in Fig. 4.

To the lower end of the electrode 121 is fastened a frame or yoke 130 within which is supported, upon pins 131, a wick 132, desirably of refractory material. Supported by and between the electrodes 120 and 121, in spaced relation to the upper end of the wick 132, is the ignition coil 135. Auxiliary air is admitted to the burner in the vicinity of the ignition coil through a perforated tube 136 that has its ends projected through apertures in the side walls of the bay 90. One end of the tube is shown as closed by a cap 137, and cooperating with the opposite end of the tube is a valve 138 that is carried by a bi-metal strip 139. The perforations of the tube 136 are designated 140 and are so located that the jets of air issuing therefrom, when the valve 138 is opened, do not impinge against the ignition coil 135, as such might unduly chill the coil. The end of the bi-metal strip 139 opposite the valve 138 is fastened to the exterior of the adjacent side wall of the bay 90 near the burner bowl, it being understood that the wall 97 is cut away to accommodate the movements of said strip.

The operation of the present embodiment will be readily understood from the description of the operation of the first form.

In the description of the operation of the apparatus illustrated in Fig. 1, reference is made to the maximum fuel level in the bowl, indicated by the dot-and-dash line *a*. Fuel feeding systems involving liquid level controls are common and well known, and for that reason it is believed to be unnecessary to illustrate such a system in connection with said apparatus. However, if an example is desired, see Chadwick Patent No. 2,293,697, dated August 25, 1942, wherein a fuel feeding system involving such a control is shown and described in connection with apparatus of the kind under discussion.

Having thus describe our invention, what we claim is:

1. In combination with a burner bowl having an opening at one side thereof, a unitary assembly comprising a member of refractory insulating material provided with spaced apertures, electrodes having their outer ends projected through the apertures of said member, means for connecting electrical conductors to the projecting outer ends of the electrodes, an electrical heating element connected to and bridging the inner ends of the electrodes, a yoke attached to one of the electrodes, and a wick supported within and by said yoke with its upper end in close proximity to but spaced from the electrical heating element, the assembly being adapted for application to the bowl with said member disposed across the opening and with the inner ends of the electrodes extending into the bowl through said opening, and means for holding said member in position across said opening.

2. In combination with liquid fuel burning apparatus comprising a burner bowl having a sump in the bottom thereof and enclosing a main combustion zone above said sump, fuel supply means for delivering liquid fuel to the burner bowl and capable of supplying fuel in quantity up to a maximum level in the sump, means forming a basin communicating with the sump and arranged to receive and retain a part of the fuel fed to the burner bowl, an igniting device in lighting relation to the basin but outside said main combustion zone and comprising spaced electrodes, an electrical heating element bridging said electrodes and sustained thereby above said maximum level, a yoke attached to one of the electrodes, a wick of refractory material forming a part of the igniting device and supported by the yoke in operative relation to the electrical heating element and arranged to absorb fuel directly from the basin and conduct it into vaporizing and lighting relation to said element while maintaining the liquid fuel out of contact with the element, ignition being communicated from the igniting device to the fuel in the basin and thence to that in the sump, and an electrical circuit including said electrodes and the heating element.

3. In combination with a burner bowl having an opening at one side thereof through which access is had to the interior of the bowl for cleaning purposes, the bowl being characterized by an outwardly projected seat surrounding said opening, a closure engaged with said seat and having an aperture, a disc-like member of refractory insulating material secured to said closure across said aperture, said member having spaced holes, electrodes having their outer ends projected outwardly through said holes, means securing the electrodes to said member, the inner ends of the electrodes being spaced apart and arranged for insertion through said opening, connectors for electrical conductors attached to the projecting outer ends of the electrodes, an electrical heating element connected to and bridging the inner ends of the electrodes, and releasable means urging the closure against the aforesaid seat.

4. In combination with a burner bowl having an opening at one side thereof through which access may be had to the interior of the bowl, an igniter in the form of a unitary attachment comprising a member of refractory insulating material adapted to be disposed across said opening and provided with spaced apertures, means for holding said member in position across the opening, electrodes having their outer ends projected outwardly through the apertures of said member and their inner ends arranged for insertion through said opening, means exterior of the member for connecting electrical conductors to the outer ends of the electrodes, an electrical heating element connected to and bridging the inner ends of the electrodes, and a wick sustained by one of the electrodes with its upper end adjacent to but spaced from said heating element.

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